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ABSTRACT

This report presents descriptive and correlational results from questionnaires administered to parents and tests administered to two groups equalling approximately 650 children from kindergarten, first, and second grade. The primary question addressed is, what is the relationship between what parents report that they do with their children in terms of activities, home-process variables, books, and other experiences and the children's science concept and process acquisition? At kindergarten-level, correlations of the indices developed from the parent questionnaires and the Wide Range Achievement Test (WRAT), the Test of Basic Experiences (TOBE-2), and Chicago Reading tests showed significant relationships on all levels. At the first grade level, significant relationships were found between the six subscores of the Error Detection Test, CIRCUS-Think It Through, and the TOBE-2. At the second grade level, results from the Sequential Test of Educational Progress (STEP) Science test and criterion-referenced tests correlated significantly with parent indices, except for experiences with parents. Science questionnaires for the parents of kindergarten, first, and second grades students are appended. (YP)

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PARENTS' REPORTS OF KINDERGARTEN FIRST-, AND SECOND-GRADE CHILDREN'S OUT-OF-SCHOOL ACTIVITIES AND THEIR RELATIONSHIP TO SCIENCE ABILITY

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Abstract

This report presents descriptive and correlational results from questionnaires administered to parents and tests administered to approximately 650 children in two cohorts at kindergarten, first, and second grade. The primary question addressed is, what is the relationship between what parents report that they do with their children in terms of activities, home-process variables, books, and other experiences and children's science concept and process acquisition? These results are from a data base of a longitudinal study in progress in three school districts.

Kindergarten parents of both cohorts report quite similar home-process activities, books, and experiences for their children, whereas at the first-grade level, Cohort 1 parents have higher scores for home-process and parent-process activities and literacy-related experiences. Cohort 2 parents have higher indices for home-applied and school activities. Second-grade parental responses for both cohorts are quite similar. Correlations of the indices developed from the parent questionnaires and the WRAT, TOBE-2, and Chicago Reading tests showed significant relationships on all measures and the index of participation, except the Chicago. At first grade, correlations were run for the six subscores of the Error Detection Test, CIRCUS-Think it Through, and the TOBE-2. Significant relationships were found between these measures and home variables for Cohort 1, and fewer indices for Cohort 2. At second grade, results from the STEP Science Test and criterion-referenced tests correlated significantly with parent indices, except for experiences with parents. Furthermore, results were significant for the three school districts participating in the study. The index of participation in activities is the most promising of the indices as it consistently correlated higher with numerous measures of child performance than did the other indices.

PARENTS' REPORTS OF KINDERGARTEN, FIRST-, AND SECOND-GRADE CHILDREN'S OUT-OF-SCHOOL ACTIVITIES AND THEIR RELATIONSHIP TO SCIENCE ABILITY

Elementary school children in the United States ranked below children from nine countries in science achievement in a recent study conducted by the Educational Testing Service. Sagan (Educational Testing Service, 1989, p. 1) described this situation as follows: "We live in a society--and a nation, and a world--exquisitely dependent on science and technology, in which hardly anyone knows anything about science and technology." As a nation, we appear to be producing a generation of scientifically illiterate youngsters.

This refrain is hauntingly familiar. Similar concerns arose in 1955 with the launch of Sputnik. The response to that Russian accomplishment was for American science educators to develop exemplary programs that represented a dramatic departure from traditional elementary school text-based instruction. The new thrust was for predominately hands-on teaching. While these programs have been found to produce higher achievement for students than traditional text-based curricula (Bredderman, 1983), they have also frequently been set aside (Mechling & Oliver, 1983, p. 43) because "what was intended to be a joyful discovery for students too often turned out to be a lost sojourn into the abstract and difficult," and teachers returned to textbooks.

We argue that while changes in science instruction are clearly needed in American schools, the changes must be accepted and implemented by teachers. The first step toward developing such changes is a program of research to inform us about current instructional practices in schools and homes. The second step is to determine how these school and home variables correlate. The third step in this process to enhance what we know about science learning in the United States today would be to conduct experiments that test the most promising relationships revealed at the descriptive and correlational analysis stages.

We also argue that it is just as important to study home factors related to children's performance in science in the early grades as it is to analyze school variables at this time. Other research has shown that in kindergarten through second grade (Meyer, Wardrop, & Hastings, 1989) children typically receive much less than an hour of science instruction per week in school. Despite these very small amounts of school time allocated to science in these lower grades, children were found to vary substantially in science knowledge as they approached the middle grades. If children were not learning science concepts and processes in school, how and where were they learning them? The home is the logical second place to study in order to begin to understand these outcomes. Therefore, this study is the first in a series of studies to examine the relationships between what parents and children do together and what parents provide that explains how children acquire science knowledge.

This report presents findings from questionnaires administered to parents of children from three school districts in the midwest participating in a longitudinal study of how children develop science concepts and processes. Kindergarten, first-, and second-grade results will be presented descriptively. The questionnaires used in this study were designed to focus on the informal home instruction parents provided to their children that may have laid the foundation for children to learn the process of the scientific method during activities such as gardening and cooking. In addition, they were designed to capture the frequencies of activities parents provided for their children such as trips to museums or the library, the kinds and numbers of science-related books and magazines the children have, and the activities the children themselves chose to perform on their own. We found no other research related to this topic, although suggestions abound (for example Browne & Browne, 1977; Beisenherz, 1980; Graika, 1981; Bieber, 1983; Barhydt, 1983) for parents to involve their children in these ways.

We believe it important to have questionnaires that relate to science processes as well as activities because we hope to find a relationship between parents' informal instruction to their children about how the world works, and the children's performance in science. We believe that it is particularly important to study the first three years of home environments because by fourth grade there is substantial variance in students' science knowledge (Barr, personal communication, 1983).

Method

Setting

The results reported are but a portion of a much larger data set collected on approximately 650 children from three school districts in the midwest. This study of the development of children's science knowledge and process development has run in tandem with a study of these same children's reading comprehension development. Parents of children participating in the study completed both the support-for-science-development questionnaires that are the focus of this report as well as literacy-related questionnaires during the first four years of the study. Each of the three school districts that the children in this sample attend has a number of unique characteristics.

District A is a small town about 45 minutes from a larger university town. Many of the parents in this community either farm or operate small businesses. This small district has a reputation for high student performance in reading and average student performance in science. Community support is very strong for the early childhood programs in this school. Any school event typically finds a thousand or more people in attendance, although there are only about 90 children per grade level in the district.

District B students live in a community less than half an hour from a much larger university town. Subsequently, many of the parents of children in this school district have a short commute to work. The parents here tend to have slightly higher economic status positions than parents from District A. In addition, mothers from this district work fewer hours each week than District A mothers. This district has a reputation for average student achievement in reading in the early elementary grades. In the period of data collection for this study, the district changed its instructional science program when it adopted a new textbook for science, offered science workshops to teachers, and appointed science coordinating teachers at each grade level.

District C represents yet another type of setting. Children from just one elementary school in this large district participate in the study. The people that compose this school community are frequently referred to as a "microcosm of the universe." White, Black, and Hispanic families make up this population. Parents in this school district range in background from single-parent domestic hourly employees to two-career professionals. This district is located in a suburb contiguous to a major city. For some families, life here may represent a move from an inner-city environment. This community also includes wealthy, established suburbanites who are often the employers of the school district's domestic workers.

Subjects

Questionnaires were sent home to all parents of the approximately 650 children in two cohorts participating in the study. The questionnaires were distributed in the spring each year during the days that the research team was in each school for spring testing. Children received small prizes, such as erasers, for returning their questionnaires. The response rate was over 84% for the kindergarten year. It increased to well over 90% by the time the children were in second grade.

Instruments

A copy of each questionnaire appears in the Appendix. Although a different questionnaire was used at each grade level, the format of the questionnaires was similar from one year to the next. Each questionnaire began with a short scenario describing settings, such as the kitchen or outside, and activities that we believed would be common to all families. The items in these scenarios included experiences parents might have provided their children while at the same time giving instruction in scientific processes. These paragraphs were developed in lieu of asking parents direct questions about what and how they taught their children because informal piloting procedures using direct questions revealed that parents often did not consider what they did with their children to be instructional. In other words, the paragraphs were designed to provide parents a mechanism for indirectly reporting their home instruction with their children.

In order to track the development of children's science concept acquisition, the Longitudinal Study Team has administered a number of psychometric measures. While some standardized measures of verbal performance of basic science understanding have been administered, we have found that such tests did

not entirely satisfy the needs of this study. Therefore, a number of measures have been developed with algorithms specifically for use within the context of this study. This section describes the standardized measures of verbal performance and basic science knowledge as well as the measures that have been *custom* developed specifically for the study. This discussion will be brief, however, because (a) details concerning the standardized tests used can be found in manuals and technical reports provided by the publishers, and (b) the *customized* tests have been described in some detail previously (Hastings, Meyer, & Linn, 1987; Hastings, Meyer, Linn, & Wardrop, in press). Table 1 at the conclusion of this section presents means and standard deviations for the sample on each measure.

Science tests were administered to the children each spring to assess their science knowledge. In kindergarten and first grade, the Test of Basic Experiences (TOBE-2) were used. In second grade, we administered the STEP Science Test as a group test and three tests developed specifically for this study. These custom tests were created after determining the common content domains covered in the science textbooks used in each of the three districts. A brief description of each test follows.

Standardized Measures of Verbal Performance

While the primary thrust of this research is to account for variance in children's acquisition and application of science concepts as opposed to their learning of rote scientific facts and vocabulary, we believed that a certain level of verbal competence was necessary for children to understand basic science concepts. Therefore, we included several measures of verbal-reading performance in our models. Several of these are standardized tests of verbal-reading performance that have been nationally normed.

Wide Range Achievement Test. We have administered the reading subtest, Level I of the Wide Range Achievement Test (WRAT), at least once a year during the course of this study. Cohort 1 was given the 1978 version (Jastak, Jastak, & Bijou, 1978) in kindergarten and first grade, and the 1984 version (Jastak & Wilkinson, 1984) beginning in second grade. Items on the WRAT consist of a series of increasingly difficult words that children read aloud to the examiner. The measure is individually administered and has a stopping rule whereby 12 consecutive errors terminate administration. Although the items are the same for both editions, the norms differ.

CIRCUS Reading Test. The CIRCUS Reading Test, Level D (Educational Testing Service, 1976) was given to our Cohort 1 children in the spring of their second-grade year. This is a relatively traditional group-administered reading test. It has a series of short passages followed by comprehension questions.

Customized Measures of Verbal Performance

Although we have used and will continue using standardized measures of reading performance, we feel that such measures do not measure exactly the latent traits we wish to study. We, therefore, created one instrument on which verbal performance could be manifested, and used two others developed by other researchers.

Standardized Measures of Basic Science Understanding

As with the measures of verbal and/or cognitive performance, we wanted to use some standardized measures as manifestation of an underlying basic science understanding. A more detailed discussion of the rationale for instruments chosen and their resultant scores may be found in Hastings, Meyer, & Linn, 1987; Hastings, Meyer, Linn, & Wardrop, in press).

TOBE. Level K and Level L of the Test of Basic Experiences (TOBE-2) (Moss, 1978a, 1978b) was used as an end-of-year dependent variable for kindergarten and first grade. Children were asked to choose the correct responses to orally administered item stems from sets of four line drawings.

Customized Measures of Basic Science Understanding

Instruments were developed that tested students on content domains that were either at or above grade level in their science textbooks. Effort was made to use vocabulary common to all three districts. Out-of-level items were included in each battery so that we could observe children "developing" knowledge about a few science topics.

Motion. The Motion Test (Meyer, Hasting, & Linn, 1986a) was entirely orally administered and had items that were exclusively out-of-level for the children. It included items with balls and mirrors. It was initially used as an end-of-second-grade manifest variable for basic science understanding.

Plants. The Plants Test (Meyer, Hastings, & Linn, 1986b) was orally administered, in that all items were read aloud to the children, even when the items included written text. This instrument contained both in-level and out-of-level items and common vocabulary and relied heavily on line drawings. It was initially used as an end-of-second grade manifest variable for basic science understanding.

Three Forms of Matter. The Three Forms of Matter Test (Meyer, Hastings, & Linn, 1986c) also had in- and out-of-level items and common vocabulary and made use of line drawings wherever possible. It was initially used as an end-of-second grade manifest variable for basic science understanding.

Measures of Verbal Performance and Basic Science Understanding

Of the various measures we have given, these might be considered galluses in that they seem to be suspended somewhere between verbal and/or cognitive performance and measures of basic science understanding. Two are nationally normed measures, and one is a measure that we developed specifically for this study.

CIRCUS-Think It Through. The CIRCUS-Think it Through (Educational Testing Service, 1976b) was used as a beginning-of-year variable for both first and second grade. It presents a series of drawings such as strings of beads or decorative plates. The children select drawings as the examiner reads short problems aloud. This is considered to be a measure of problem solving ability.

Error Detection. The Error Detection Test (Meyer, Hastings, & Linn, 1985) was administered to both first and second graders in the study. This instrument used vocabulary common to all three districts, and it depended on science content about plants also common to all three schools. The instrument attempts to measure a cognitive domain: detection of errors in written sentences and sequences and children's ability to provide support for their definitions of errors. The instrument yields six scores: Decoding Errors on two subtests; Identification of Absurd Target Word, and Support for it; and Identification of what happened at the wrong time, and Support for it. Decoding errors were also recorded, then children were told the correct words.

STEP Science. The Science subtest of the Sequential Test of Educational Progress (STEP) (Educational Testing Service, 1979) was given to our Cohort 1 children in the spring of their second grade year. The STEP Science subtest tends to load more with "reading measures" than it does with certain "science concept" measures, specifically the TOBE-2, and the three instruments that were developed specifically for this study, Motion, Plants, and Three Forms of Matter. This was true for both a promax rotated forced two factor analysis (Hastings, et al., 1987) and a confirmatory two factor analysis using LISREL (Hastings, et al., in press). This may be due to the fact that students must read items on this instrument silently in order to respond.

[Insert Table 1 about here.]

Questionnaires. Items believed to measure similar constructs were combined to form indices from the parent questionnaires at each grade level. For example, the index of participation in activities was made up of items focused upon things parents did with their children. The first item in the kindergarten questionnaire, "You (strongly encourage, encourage, accept, discourage, strongly discourage) your children's presence in the kitchen," is typical of this kind of item because it deals with parents' involvements with their children in processes that take place at home. Other items focus directly on the number of books or magazines the children have. These items together form an index of the number of science books and magazines available to children. The index of parent-sponsored activities was developed from the frequencies of visits parents reported for their children to museums, woods, nature walks, etc. At other grade levels, indices of "home-applied" activities and school activities were also developed from questionnaire items that asked specifically about children's involvement in activities on their own as well as the science-related school work that they brought home.

The information gleaned from these questionnaires is presented first by index, and then as correlations of questionnaire indices with tests administered at each grade level (kindergartèn, first, and second grade).

Results

Kindergarten

Indices of responses. Table 2 shows parents' responses for both cohorts of children at the end of their kindergarten years. Cohort 1 parents reported slightly more home-process activities and science-related books for their children than did Cohort 2 parents. Cohort 2 parents, however, reported more experiences for their children. When separating the cohorts into districts, for both cohorts, District B parents reported slightly more home-process activities and experiences for their children than either the parents in District A or the parents in District C. The highest reported number of books fluctuated from District C for Cohort 1 to District A for Cohort 2.

[Insert Table 2 about here.]

First Grade

Indices of responses. Table 3 shows the indices of the Cohort 1 and 2 parents' responses to the first-grade questionnaire. The paragraphs in this questionnaire focused on what parents do with their children's school work, and the parents' inclusion of their children in activities that linked home activities with plants. As previously noted, plants was a content domain covered in all three schools at this grade level. On this questionnaire, parents' responses differed some in magnitude from one index to another. Cohort 1 parents had higher scores for home-process activities, parent-process activities, and literacy-related experiences, whereas Cohort 2 parents had higher indices for home-applied and school activities.

Differences between districts are also apparent in Table 3. District B parents had the highest indices for home-applied activities, parent-sponsored activities, and literacy-related activities. District C Cohort 1 parents reported the greatest overall attention to school activities. District A parents showed the greatest number of home process activities.

[Insert Table 3 about here.]

Cohort 2 parents presented a relatively consistent pattern. District C parents have the highest index in all but the literacy-related category.

Second Grade

Indices of responses. Table 4 shows responses from second-grade parents as well as the parents' responses divided by district for parent-sponsored activities, school activities, and children's participation in science-related activities. These indices show great similarity for parental responses from the three districts with slightly greater home-process activities in District A. Greater school activities and parent-sponsored activities were reported for District C, Cohort 1. District B had greater home-process and school activities while District C showed slightly greater parent-sponsored activities with Cohort 2.

[Insert Table 4 about here.]

Correlational Results

Kindergarten. Table 5 shows the correlations for three child measures, the decoding subtest of the WRAT, which was administered in the fall of kindergarten; three indices from the parent questionnaires; and two spring measures, the TOBE-2, a general test of science knowledge, and the Chicago Reading Test, a test of letter sounds, word endings, and word recognition.

The indices represent the child's participation in activities with parents, the number of books and magazines that were related to science topics that the child had regular access to at home, and

experiences the child had with adults, such as taking trips to a zoo or a museum. Results for Cohort 1 children are above the diagonal and results for Cohort 2 are below the diagonal.

Significant relationships were found for the index of participation for both cohorts on all measures except the Chicago Test. The correlations are generally higher for Cohort 2 children than they were for Cohort 1 students. The index of books and magazines correlated significantly with the index of participation and experiences with adults for Cohort 2 and Cohort 1. The index of experience with adults yielded significant correlations with each of the other indices for both cohorts and all measures except the Chicago for Cohort 1. Thus, overall, very similar results for kindergarten child measures and parent questionnaires were found for both cohorts.

[Insert Table 5 about here.]

First grade. Table 6 shows the results of correlational analyses for first-grade instruments and parent questionnaires for both cohorts. In these analyses, the six subscores of the Error Detection Test, the total score for the CIRCUS-Think it Through Test, the TOBE-2 end-of-first grade results and five indices were correlated. The parent indices represent the child's participation in activities at home and at school, field-trip-type experiences with parents, and then process, or literacy-based experiences that took place at home.

Significant relationships were found for all subtest scores on the Error Detection Test and the TOBE-2 for both cohorts. Participating in activities at home correlated significantly with the TOBE-2 and Error Detection decoding errors and support for impossible sequences, whereas the index of school activities correlated significantly only with participating in activities at home. Experiences with parents, process experiences, and the children's ability to identify absurd target words produced low correlations.

Cohort 2 results generally replicated results found for Cohort 1 children, except that the CIRCUS-Think it Through Test correlated significantly with all of the Error Detection subtest scores and the TOBE-2. Indices from the parent questionnaires yielded generally non-significant correlations for Cohort 2 students, except for participation in activities, support for absurd target words, process experiences with identification of and support for impossible sequences, and experiences with parents.

[Insert Table 6 about here.]

Table 7 shows the correlational results for second-grade child measures and parent indices. The Error Detection scores are from administering that test in the fall of second grade. The spring child measures are the STEP Science Test and the three instruments designed for this study. In addition, there are three indices from the parent questionnaires: experiences with parents, school activities, and participation in activities. The CIRCUS Reading Test was administered to Cohort 1 students only.

The relationships found for the Error Detection Test administered in the fall of second grade are quite similar to results found with that instrument at the end of first grade. Correlations for the two decoding scores are exceptionally high. Other subtest correlations are generally significant, though moderate. The STEP Science Test correlated significantly with the Error Detection subtests for both cohorts. It also correlated significantly with the other child measures and parent indices, except for experiences with parents. Similar results were found for the Plants and Three Forms of Matter Tests, except that the relationship between the Plants Test and index of school activities produced a non-significant correlation. The Three Forms of Matter Test also yielded a non-significant correlation with the index of experiences with parents for Cohort 2 as did the Motion Test. The CIRCUS Reading Test correlated particularly highly with the decoding scores on the Error Detection Test and the STEP Science Test, which might be expected as these are all instruments that required the students to read. The index of participation in activities is the most promising index from the parent questionnaires as it correlated higher with numerous measures of child performance than the other indices.

[Insert Table 7 about here.]

Discussion

The results as presented in the indices were rather consistent from district to district. These results were somewhat unexpected because although all districts offered a variety of resources for families, the

District C school provided a greater number of field trips and school programs designed to bring experiences to the children. In addition, this school was observed to be the least text-based, the most experience-oriented of the three. Furthermore, parents of children in this school had a broader range of resources, such as museums, available to them than parents had in the other districts. Despite these opportunities, District C parents did not report utilizing these resources more frequently than did parents in the other districts.

The questionnaire responses did show some changes in reported home-process activities from kindergarten to second grade. Children generally became more involved as they got older. This involvement was then reflected in the relationship between the indices of participation and the science measures.

What have we learned from sending questionnaires to the parents of almost 650 children for a three-year period and then correlating the parents' responses with their children's performance in reading and science?

First, at all three grade levels, parents in both cohorts responded similarly on all indices. The similarities in these data suggest that these self-report responses are highly reliable. Therefore, these results alone are encouraging since self-report data are often feared to be unreliable.

Second, at the kindergarten level, the significant correlations for reading and science tests and all of the parent indices *except* the number of books and magazines suggest that what parents may do with their children is more important than the materials they provided for them. These same results were found at the first-grade level thereby strengthening the relationships between what parents did with their children and the children's performances in reading *and* science.

Third, strong relationships were found between the reading measures and the science measures, especially at the kindergarten and first-grade levels. In each case, at these grade levels, the science tests administered to the children required them to look at pictures and make their own judgments about what the illustrations depicted. In contrast the custom-designed science tests at the second-grade level were administered by having the examiner read all items to the children and describe the illustrations as well. Additional analyses of these texts administered at the second-grade level (Hastings, Meyer, & Linn, 1987) revealed that the custom tests loaded together when a factor analysis was performed.

The norm-referenced science test loaded with the reading measures. These results are very encouraging because they suggest that the custom tests may in fact be measuring a construct that we can generally call science knowledge.

It is also very encouraging that at all three grade levels that are the focus of this report, children's participation in activities parents provided was significantly related to the children's performance on the science measures, particularly the custom measures. Children's participation in activities showed a much stronger relationship to children's science ability than did the number of books and magazines they had available to them. Therefore, it appears to be that the active involvement that parents have with their children, more so than activities children can engage in on their own, such as those that would more traditionally be considered "playing" or reading, benefits science learning. These data suggest that in the earliest elementary grades, it is children's participation in activities with their parents that accounts for the science concept and process learning that takes place.

Further research in this area might focus on more precisely what kind of participation in activities with parents results in the greatest gains in student performance in science. These are questions well suited for experimental studies to examine the relationship between what parents do with their children and the advancement of their achievement in science concepts and processes.

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Table 1

Means and Standard Deviations for all Measures of Student Ability

Instrument	Administered	*X*	*SD*
WRAT Level 1 Reading Subtest	fall, kindergarten	19.07	7.28
TOBE-2, Level K	spring, kindergarten	20.87	3.89
WRAT, Level 1 Reading Subtest	fall, first grade	28.54	7.94
Circus: Think it Through, Level B	fall, first grade	23.86	3.78
Error Detection: Word Errors identified	spring, first grade	8.82	1.58
Error Detection: Support for Word Errors	spring, first grade	8.34	2.04
Error Detection: Sequencing Errors Identified	spring, first grade	3.73	1.46
Error Detection: Support for Sequencing Errors	spring, first grade	3.05	1.53
TOBE-2, Level L	spring, first grade	21.71	2.83
WRAT Level 1 Reading Subtest	fall, second grade	49.26	9.84
Circus: Think It Through, Level C	fall, second grade	24.71	5.69
Error Detection: Word Errors Identified	fall, second grade	8.99	1.18
Error Detection: Support for Word Errors	fall, second grade	8.57	1.55
Error Detection: Sequencing Errors Identified	fall, second grade	4.10	1.43
Error Detection: Support for Sequencing Errors	fall, second grade	3.11	1.59
Circus: Reading Test Level D	spring, second grade	31.53	7.83

Table 1 (Cont.)

STEP: Science	spring, second grade	36.11	7.38
Plants Test	spring, second grade	21.63	3.68
Three Forms of Matter Test	spring, second grade	20.31	5.23
Motion Test	spring, second grade	11.66	2.33

Table 2

Indices of Parental Reports of Kindergarten Children's Home-Process Activities, Books, and Parent-Sponsored Activities Related to Science

			Indices of					
			Home Process Activities		Books		Parent Sponsored Activities	
Cohort	District(s)	*N*	*x*	*SD*	*x*	*SD*	*x*	*SD*
1	All	250	18.03	(5.85)	14.12	(6.56)	31.55	(5.99)
2	All	268	17.63	(6.45)	12.05	(7.46)	32.25	(5.53)
1	A	81	17.20	(5.61)	13.23	(5.86)	30.88	(5.16)
	B	121	18.51	(5.79)	14.16	(6.39)	31.89	(5.83)
	C	48	18.21	(6.36)	15.54	(7.87)	31.84	(7.62)
2	A	78	17.55	(5.50)	12.97	(7.11)	32.10	(5.42)
	B	130	18.12	(6.69)	12.16	(7.82)	32.33	(4.96)
	C	53	16.43	(7.04)	10.51	(7.15)	31.81	(7.16)

Table 3

Indices of Parental Reports of First-Grade Children's Home-Process Activities, Home-Applied Activities, Parent-Sponsored Activities, School Activities, and Literacy Experiences Related to Science

			Home Process Activities		Home Applied Activities		Parent Sponsored Activities		School Activities		Literacy Related Experiences	
Cohort	District	*N*	*x*	*SD*	*x*	*SD*	*x*	*SD*	*x*	*SD*	*x*	*SD*
1	All	293	34.19	(6.10)	4.74	(1.83)	10.37	(6.11)	5.89	(3.08)	1.69	(1.46)
2	All	265	33.08	(6.30)	4.95	(1.90)	10.31	(6.32)	5.95	(3.03)	1.55	(1.28)
1	A	80	34.60	(6.06)	4.46	(1.59)	9.82	(6.50)	5.97	(3.24)	1.72	(1.42)
	B	148	34.17	(5.83)	4.97	(1.81)	10.86	(5.96)	5.40	(2.74)	1.79	(1.51)
	C	65	33.70	(6.81)	4.57	(2.08)	9.94	(5.93)	6.90	(3.39)	1.43	(1.37)
2	A	72	33.78	(6.24)	4.65	(1.77)	9.46	(5.83)	4.94	(3.03)	1.57	(1.18)
	B	139	32.76	(5.87)	5.00	(1.92)	10.48	(6.26)	6.05	(2.75)	1.54	(1.31)
	C	53	32.98	(7.40)	5.25	(1.97)	10.98	(7.04)	6.95	(3.34)	1.53	(1.35)

Table 4

Indices of Parental Reports of Second-Grade Children's Home-Process, School, and Parent-Sponsored Activities Related to Science

			Activities					
			Home Process		School		Parent Sponsored	
Cohort	District(s)	*N*	*x*	*SD*	*x*	*SD*	*x*	*SD*
1	All	261	10.82	(6.18)	6.88	(2.70)	46.15	(11.45)
1	A	66	11.08	(5.84)	7.11	(2.87)	46.39	(9.51)
	B	129	10.71	(6.24)	6.47	(2.45)	45.74	(11.67)
	C	66	10.78	(6.47)	7.43	(2.90)	46.72	(12.87)
2	All	238	10.76	(6.30)	6.88	(2.86)	45.91	(11.44)
	A	68	9.94	(6.02)	5.67	(2.89)	44.91	(9.69)
	B	128	11.26	(6.18)	7.60	(2.580	46.29	(11.82)
	C	42	10.64	(7.12)	6.75	(2.93)	46.36	(12.95)

Table 5

Cohort 1 & Cohort 2 Kindergarten Child Measures and Parent Indices

	Total WRAT, FK	Index of Part., SK	Index # Bks. & Mags.	Index of Exp. w/ Adults	TOBE2, SK	Chicago, SK
Total WRAT, FK	1.00	.24	.17	.24	.52	.61
Index of Part., SK	.21	1.00	.39	.32	.27	.20
Index # Bks. & Mags.	.14	.42	1.00	.31	.12	.13
Index of Exp. w/ Adults	.23	.42	.35	1.00	.21	.17
TOBE 2, SK	.45	.34	.21	.25	1.00	.39
Chicago, SK	.64	.19	.19	.22	.43	1.00

Cohort 1 is above the diagonal. Lowest N = 218. Correlations above .22 are significant $p < .001$.

Cohort 2 is below the diagonal. Lowest N = 242. Correlations above .21 are significant $p < .001$.

Table 6

Cohort 1 & Cohort 2 First-Grade Child Measures and Parent Indices

	EDATWDEC,S1st	EDATWID,S1st	EDATWS,S1st	EDISDEC,S1st	EDISID, S1st	EDISS,S1st	Total Circus T1T, S1st	TOBE 2, S1st	Index Part In Act	Index Sch Act	Index Exp w/P's	Index Process Exp	Index Literacy Exp
EDATWDEC, S1st	1.00	-.50	-.50	.92	-.28	-.31	-.25	-.38	-.25	-.14	-.03	-.22	-.02
EDATWID, S1st	-.47	1.00	.83	-.51	.42	.43	.14	.34	.18	.13	.02	.25	.17
EDATWS, S1st	-.49	.72	1.00	-.50	.43	.50	.23	.37	.17	.12	.09	.21	.13
EDISDEC, S1st	.98	-.48	-.49	1.00	-.29	-.29	-.24	-.38	-.26	-.12	-.05	-.20	-.03
EDISID, S1st	-.40	.45	.48	-.38	1.00	.80	.18	.23	.15	.00	.03	.12	.10
EDISS, S1st	-.40	.37	.46	-.41	.68	1.00	.21	.27	.23	.05	-.03	.16	.07
Total Circus T1T, S1st	-.41	.29	.37	-.38	.22	.32	1.00	.43	.16	.15	.09	.09	.05
TOBE 2, S1st	-.34	.37	.34	-.34	.28	.34	.53	1.00	.26	.09	.04	.16	.11
Index Part In Act	-.13	.17	.22	-.13	.09	.12	.11	.08	1.00	.22	.23	.26	.03
Index Sch Act	-.03	.09	.10	-.04	.16	.15	.08	.14	.14	1.00	.19	.18	.02
Index Exp w/P's	-.17	.16	.13	-.20	.16	.15	-.04	.04	.10	.19	1.00	.29	-.10
Index Process Exp	-.15	.08	.14	-.15	.25	.27	.01	.11	.15	.18	.36	1.00	.21
Index Literacy Exp	.02	.05	.02	.00	.03	.05	-.06	-.02	-.10	.16	.02	.09	1.00

Cohort 1 is above the diagonal. Lowest N = 280. Correlations above .20 are significant $p < .001$.
Cohort 2 is below the diagonal. Lowest N = 238. Correlations above .21 are significant $p < .001$.

Table 7

Cohort 1 and Cohort 2 Second-Grade Child Measures and Parent Indices

	EDATWDEC, F2nd	EDATWID, F2nd	EDATWS, F2nd	EDISDEC, F2nd	EDISID, F2nd	EDISS, F2nd	STEP SCI, S2nd	PLANTS, S2nd	3 Forms of M, S2nd	Motion, S2nd	Index of Exp w/P's	Index of Sch Act	Index of Part in Act	Circus Rdg, S2nd
EDATWDEC,F2nd	1.00	-.49	-.54	.97	-.41	-.36	-.61	-.32	-.32	-.08	.00	-.14	-.20	-.68
EDATWID,F2nd	-.30	1.00	.86	-.47	.34	.32	.43	.35	.25	.12	-.02	.03	.05	.41
EDATWS,F2ns	-.41	.81	1.00	-.52	.40	.40	.47	.41	.31	.10	.01	-.03	.10	.46
EDISDEC, F2nd	.97	-.31	-.42	1.00	-.41	-.37	-.62	-.29	-.33	-.06	-.01	-.16	-.21	-.71
EDISID,F2nd	-.28	.28	.34	-.29	1.00	.75	.38	.24	.30	.08	.09	.07	.18	.36
EDISS,F2nd	-.39	.32	.45	-.40	.69	1.00	.41	.32	.31	.04	.04	.06	.18	.38
STEP SCI, S2nd	-.64	.34	.52	-.64	.41	.54	1.00	.57	.61	.27	.15	.10	.24	.79
PLANTS, S2nd	-.31	.28	.31	-.30	.23	.40	.53	1.00	.55	.26	.12	.00	.20	.42
3 Forms of M, S2nd	-.37	.29	.39	-.38	.27	.40	.61	.48	1.00	.28	.14	.08	.23	.54
Motion, S2nd	-.14	.11	.22	-.15	.13	.25	.30	.35	.39	1.00	.07	.07	-.01	.18
Index of Exp w/P's	-.19	.10	.12	-.16	.16	.19	.16	.19	.08	.12	1.00	.09	.19	.04
Index of Sch Act	-.19	.09	.13	-.17	.12	.19	.27	.20	.28	.21	.17	1.00	.16	.15
Index of Part in Act	-.22	.13	.15	-.22	.18	.24	.25	.24	.23	.08	.28	.27	1.00	.24
*Circus Rdg, S2nd														1.00

Cohort 1 is above the diagonal. Lowest N = 247. Correlations above .21 are significant $p < .001$.
Cohort 2 is below the diagonal. Lowest N = 217. Correlations above .22 are significant $p < .001$.

Appendix

Kindergarten
Science Questionnaire

As you read the next part of this questionnaire, put yourself into the story and answer as if you were telling this story about you and your kindergarten child. Circle the word(s) that describe you best. If another setting, such as a garden or garage is more typical for you and your child than the one we have picked, think of that setting as you choose your answers.

It is Saturday morning and you are about to start breakfast. You (**strongly encourage, encourage, accept, discourage, strongly discourage**) your children's presence in the kitchen. When your kindergartner is with you in the kitchen, you (**very often, often, occasionally, seldom, never**) talk to your child about what you are doing. For example, you are (**very likely, likely, may, unlikely, very unlikely**) to describe how to cut or fix things. In fact, your kindergartner has (**very often, often, sometimes, seldom, never**) fixed scrambled eggs and other things. Your child already seems to understand (**very well, pretty well, well, poorly, very poorly**) why he/she has to measure, mix, and cook most things before they are ready to eat. As your child helps in the kitchen, you (**very often, often, sometimes, seldom, never**) find yourself explaining how to do things, and why to do things. Your child can identify the uses of (**10+, 7-9, 6-3, 2-0**) gadgets and equipment in the kitchen. It is (**very likely, somewhat likely, likely, somewhat unlikely, unlikely**) that your kindergartner has had experiences helping an adult prepare a meal. Usually, this adult is (**a man, a woman, both**). And experiences like this occur in your house (**10+, 6-9, 3-5, 1-2, 0**) times a week.

In the blank to the left of the activity, please write how many times your kindergarten child has been to these places or done these things.

____ museum	____ park
____ library	____ garden
____ woods	____ nature walk
____ zoo	____ farm

Now, on the blank to the left of these categories, write how many books or magazines of this type your child has (either owns, or borrows).

____ dinosaurs	____ airplanes	____ weather
____ animals	____ cars	____ travel
____ trees	____ flowers	____ sets of encyclopedias
____ birds	____ food	

Now, for the next list, check the three activities your child likes to do most at home or some place else.

_____ plant seeds
_____ play with water
_____ mix colors
_____ play in sand
_____ play outside
_____ watch TV
_____ build with blocks or other objects
_____ play with cards
_____ bounce balls
_____ collect objects of interest
_____ listen to music

This summer my child (will/will not) spend quite a bit of time away from home.

If your child will spend time away from home, please check the activities below that she/he will do.

_____ summer school
_____ travel
_____ day care
_____ camp
_____ other _____

First Grade
Science Questionnaire

As you read through the paragraphs below, put yourself into the story and circle the word or words in parentheses that best describe you and your first grader. If you don't have a garden, but if you do similar activities in another setting, answer the questionnaire as if it took place there.

It is early evening and you see your first grader for the first time since the school day ended. Your child has brought home (**0, 1-3, 4-6, 7-9, 10+**) papers. Usually, (**you ask to see, your child shows you, you seldom see, you never see**) your child's work. If you look at your child's work, you will go over (**all, most, some, a few, none**) of these papers with your child. Usually, your child brings home (**0, 1-2, 3-4, 5-6, 7+**) science papers or activities every week. Of these papers, (**0, 1-2, 2-3, 4-5, 6+**) include activities for you to do at home with your child.

Today's science work is a drawing of a plant. You now ask your child about (**the school paper, a real plant, a new picture or drawing**) because you want to be sure your child knows (**the names, the functions**) of the parts. You (**always, often, occasionally, seldom, never**) try to link what your child is doing in school with activities at home.

Now that you know your child is studying plants, you begin to think about other things to do with your child such as (**buying books about plants, going to the botanical gardens**, or **having your child help you in the garden**).

Now pretend it is late spring and you have decided to plant a garden. You (**definitely, probably, may, probably won't, won't**) plan the garden with your child. You feel that (**books, talks, activities**) are the best ways for your child to learn about the world. You (**will, may, won't**) talk about how to prepare the soil, the importance of sunlight, rain, and food, things you want your child to know about. When you work in the garden, you want your child to (**talk, watch, work, just be there**) with you.

As the plants grow you are (**very likely, likely, somewhat likely, unlikely**) to pull up a plant to show your child all the parts of the plant and (**name, discuss**) what each part does. You (**always, usually, may, probably won't, won't**) have similar talks about how fast different plants grow, or the part of the plant we eat for food.

This story about plants or another story very similar to it is (**very likely, likely, somewhat likely, unlikely**) to take place in your family. If scenes like this take place, they occur (**very often, often, occasionally, rarely**), and they are most likely to take place with a (**woman, man, both**).

1. If you child could choose just ONE book from the categories below, which one would it be?

___dinosaurs	___airplanes	___weather
___animals	___cars	___travel
___trees	___flowers	___how things work
___birds	___food	___human body

2. Check below ALL kinds of science work your child has brought home from school this year.

___worksheets	___experiments	___pictures

3. Check below ALL the science topics your child has studied in school this year.

___plants	___animals	___colors & shapes
___living/non-living things	___earth	___sky
	___self care	___water & air
___weather		

4. Please write how many times your child has been to these places or done these things during this school year.

___museum	___park
___library	___garden
___woods	___nature walk
___zoo	___farm

5. If your child could choose just ONE thing to do from the list below, what would that be?

___plant seeds	___build things
___play with water	___play with cards
___mix colors	___play with balls
___play in sand	___collect things
___watch TV	___listen to music
	___take things apart

Second Grade
Science Questionnaire

As you read through on paragraphs below, put yourself into the story and circle the word or words in parentheses that best describe you and your second grader. If you don't cook with your child, but if you do similar activities in another setting, answer the questionnaire as if it described that activity.

It is Wednesday evening and you and your family are going to have pancakes for dinner. Your second grader is **(always, very likely, likely, somewhat likely, unlikely)** to be in the kitchen with you. In fact, your second grader **(always, almost always, sometimes, seldom, never)** really helps with dinner. Your child is **(very likely, likely, somewhat likely, somewhat unlikely, unlikely)** to suggest pancakes on a busy evening because he/she can do **(virtually all, almost all, most, some, a little)** of the preparation alone.

Your child knows **(all, almost all, most, some, few)** of the ingredients for pancakes, and you **(always, almost always, sometimes, seldom, never)** explain why various ingredients are in recipes as your child learns to prepare a new dish. For examples, your child is **(very likely, likely, somewhat likely, somewhat unlikely, unlikely)** to know that baking powder releases a gas as the batter cooks to puff up the pancakes.

You **(always, almost always, sometimes, seldom, never)** explain the changes ingredients undergo as you cook together. Your child **(always, almost always, sometimes, seldom, never)** knows to wait for all of the butter or shortening to melt on the griddle before cooking the first pancake. In fact, your child is **(very likely, likely, somewhat likely, somewhat unlikely, unlikely)** to know to test the pan or griddle to see if it is hot enough by putting a couple of drops of water on it to see if they bounce and sputter.

4. Please write how many times you child has been to these places or done these things during this school year.

___museum	___park
___library	___garden
___woods	___nature walk
___zoo	___farm

5. If your child could choose just ONE thing to do from the list below, what would that be?

___plant seeds	___build things
___play with water	___play with cards
___mix colors	___play with balls
___play in sand	___collect things
___watch TV	___listen to music
___build models	___take things apart
___play board games	